AIRCELL® REDICOMM™ HIGH TEMPERATURE PLENUM CABLE

The first communications cable assembly for two-hour fire-rated installations

How Trilogy APH012J50 maintains continuous communications during the two-hour UL 2196 burn test and is more cost effective than standard plenum cable installations.

Executive Summary

Today's In-building Communications Systems primarily use coaxial cables to distribute Radio Frequency (RF) signals throughout a building. The applicable fire codes are interpreted as requiring the cables to survive the two-hour circuit integrity testing method per the UL 2196 Standard. Industry standard plenum cables are manufactured with materials which structurally fail around 300°F, rendering them non-functional for transmission of RF signals. To meet the two-hour requirement, many Authority Having Jurisdictions (AHJs) are requiring protective assemblies that include installing the cable inside rigid steel conduit and wrapping it with up to five layers of a thermal protective barrier. Trilogy has developed a high temperature plenum cable (part number APH012J50) which is stable, on its own, up to 1100°F; and meets the two-hour fire test requirement when protected by only three layers of a thermal protective barrier. The result is a solution which not only operates at much higher temperatures than standard plenum cables, but is significantly more cost effective to deploy.

UL 2196 Cable Performance Testing Overview

The UL 2196 test is designed to evaluate the integrity of power, control, instrumentation, and data cables for their ability to maintain circuit integrity when subjected to standard fire test exposure and associated hose stream test. The fire test consists of a two hour burn test subject to temperatures up to 1850°F. The hose stream test represents thermal shock and vibration after which the cables must perform electrically to pass the test. All product testing and evaluation was performed by an OSHA-recognized Nationally Recognized Testing Laboratory (NRTL) which is entitled by the Federal Government to test and certify products. The construction and operation of the furnace, hose stream test, and other general test conditions were in accordance with the requirements in CAN/ULC S101, Standard Methods of Fire Endurance Tests of Building Construction and Materials, and ANSI/UL 263, Standard for Fire Tests of Building Construction and Materials.

Coaxial cables are designed to transmit RF signals which is not accounted for in the scope of UL 2196 (Current Edition #2, dated 2017-08-29). Deviations from the standard include the omission of the free-air tensile strength test, as the cable is enclosed in the assembly and is therefore not feasible to perform per the standard. Other deviations are outlined in the Test Configuration and Test Methodology sections.

Test Assembly

- Trilogy High Temperature Plenum Cable APH012J50 installed in assembly.
- Assembly consisted of:
    - Cables installed in two-inch diameter rigid steel conduit.
    - Conduit wrapped in three layers of 3M™ Interam™ Endothermic Mat E-5A-4 per the manufacturer's recommendation.
    - 3M™ Filament Tape 898, 3M™ Aluminum Foil Tape 425, and 3M™ Fire Barrier Sealant CP 25WB+ used as needed per the manufacturer's recommendation.

Test Configuration

- The RF signal level test platform (Figure 1) allows a through path for the signal to be transmitted from the signal generator, through the cables under test, and be received by the signal generator.
- Thermocouples are used to monitor furnace temperatures.

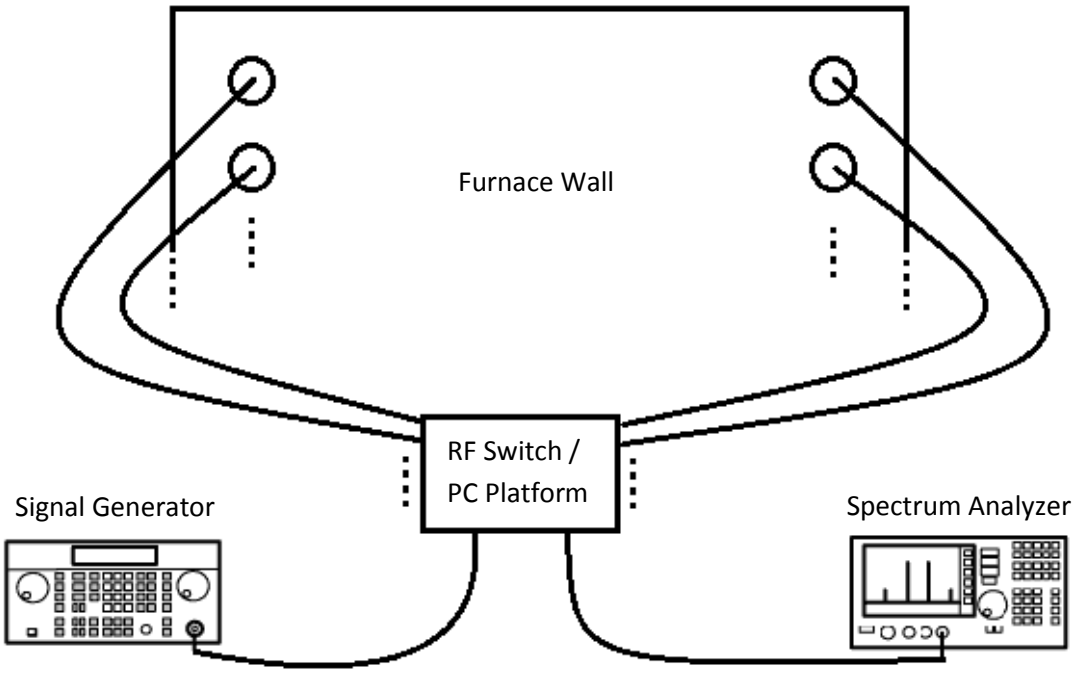

Figure 1: RF Signal Level Testing Platform

Figure 2: Mounting assembly on exposed side

Figure 3: Moving assembly wall onto test furnace

Figure 4: Signaling equipment connected

Figure 5: Furnace Interior during burn test

Test Methodology

- Time/temperature methodology utilized per cellulosic fire exposure in UL 2196-2017.
- Prior to the commencement of the fire test, a measurement with the complete RF signal level test platform including coaxial cables was performed to obtain a baseline RF signal level value.
- The cables were simultaneously evaluated for RF signal loss during and after both fire and hose stream tests utilizing a signal generator and spectrum analyzer.
- The RF signal level at the Spectrum Analyzer was recorded at intervals not exceeding 2 minutes for the duration of the fire test.
- A cable sample is considered to pass if the signal loss threshold of 5 dB or less is maintained throughout the fire test exposure and associated hose stream test.

Test Results

Trilogy APH012J50 UL 2196 test certified results demonstrate that it will operate without significant signal degradation at furnace temperatures up to 1850°F over the two-hour burn test, when utilized in an assembly needing only three layers of thermal protective barrier. The change in signal strength at the end of the two-hour furnace test was a maximum of about one dB (Figure 6).

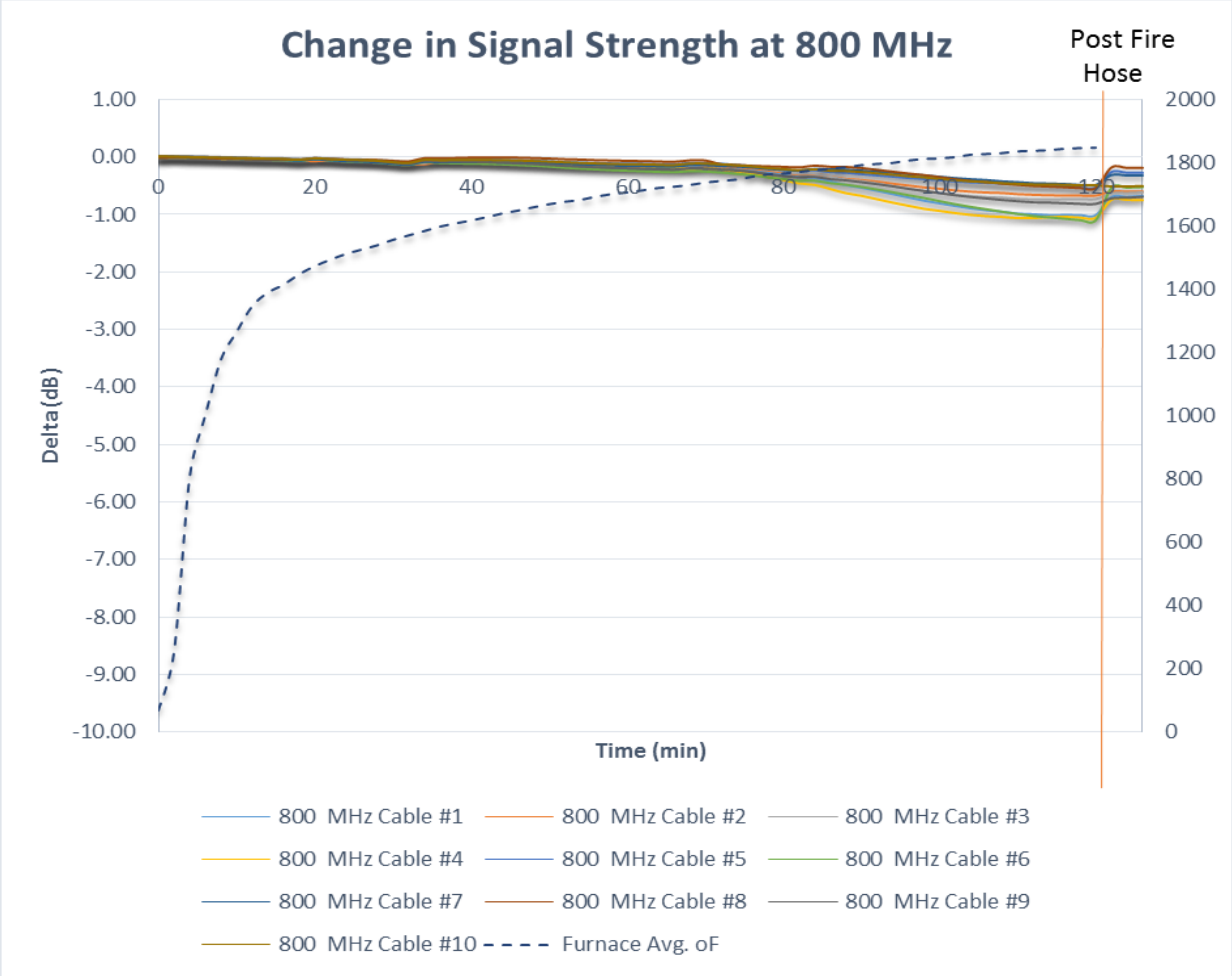

Figure 6: Change in signal strength at 800 MHz

Cost Analysis

Because Trilogy APH012J50 can operate at higher temperatures, compared to standard plenum cables, it requires fewer layers of thermal protective barrier to maintain performance. This results in a significant overall cost advantage. See Table 1 below for the estimated total cost of materials and labor for a ten-foot section of a three-layer wrap assembly as needed for Trilogy APH012J50 versus a five-layer wrap assembly as required for the industry standard plenum cable.

Conclusion

Trilogy APH012J50 survives the two-hour circuit integrity test per UL 2196-2017 with certified results that demonstrate the ability of the coaxial cable to maintain RF signal integrity over the duration of the fire test. The ability of the cable to operate at much higher temperatures compared with an industry standard plenum cable also results in a significant installation cost advantage.

Please contact Will Bodnar at wbodnar@trilogyrf.com or 717-201-1829 for a copy of the NRTL certified test report.

Costing for 10 ft Assembly	3 Wraps	5 Wraps
Insulation Required for 2.25" x 10' Straight Conduit (in 3M Emat Rolls)	0.99	1.98
Cost (based on $800 per roll)	$ 792.00	$ 1,584.00
3M Aluminum Foil Tape Type 425 Required (6" x 60yd Roll)	0.87	3.57
Cost (Based on $205 per roll)	$ 178.36	$ 731.86
3M Fire Barrier Sealant Part# CP 25WB+ cost	$ 18.00	$ 18.00
Scotch® Filament Tape 898 Cost	$ 21.65	$ 21.65
Total Material Cost:	$ 1,010.01	$ 2,355.51
Labor time (total man minutes):	120	140
Cost (Labor at $100.00 per hour)	$ 200.00	$ 233.33
Total Cumulative Cost Per Foot Per 2.25" x 10' Straight Conduit	$ 121.00	$ 258.88
Total Cumulative Cost for Materials and Labor:	$ 1,210.01	$ 2,588.85

Table 1: Estimated Costing for 10 ft Assembly for 3 wraps vs. 5 wraps

References:

3M™ Interam™ Endothermic Mat E-5A-4 Solution

https://www.3m.com/3M/en_US/company-us/all-3m-products/~/3M-Interam-Endothermic-Mat-E-5A-4/?N=5002385+3293123897&rt=rud

3M Fire Protection Products Estimation Tool

https://www.3m.com/3M/en_US/building-construction-us/applications/emat/fire-protection-products-estimation-tool/